or not; by placing one's hand on them the only slight vibration discernible is right aft, and is due to the propellers. (5) The low centre of gravity of the turbine machinery has given good stability in the *King Edward* without either a "hard bilge or long floor," rendering this class of machinery conducive to high speeds. During the trials Rothesay was "made" as an experiment, and the vessel behaved splendidly, coming to easily and quickly—an important point in passenger excursion traffic, for which the steamer is intended. The *King Edward* is now on her run in Scotland, and is by far the fastest boat of her class.

WE have received from Messrs. Baker and Co., of Newark, U.S.A., an illustrated catalogue of platinum apparatus for use in large and small college chemical operations. The illustrations show a variety of useful contrivances for laboratory purposes, and the catalogue concludes with some valuable observations on the use and care of platinum, on the cleaning of platinum wire, and with some tables which will much assist in calculating the weight, and therefore the price, of platinum apparatus.

THE popular science lectures for young people, which have been given at the Kensington Town Hall during the autumn and winter, will be continued in October next. The aim is to interest juveniles in various aspects of scientific study and encourage them to view natural objects and phenomena in a sympathetic frame of mind. The subjects of lectures arranged for the autumn are secrets in sands, by Mr. C. Carus-Wilson; waves of sound and waves of light, by the Rev. J. O. Bevan; colour and colour photography, by Dr. A. H. Fison; flowers and their insect visitors, by Prof. J. B. Farmer, F.R.S.; and secrets in flint pebbles, by Mr. C. Carus-Wilson.

MR. EDWARD STANFORD has published a South Polar chart which will be of service in following the progress of the expeditions about to sail for Antarctic regions. The chart indicates, by contours and eight shades of blue, the ocean depths, so far as they are known, down to 5000 fathoms and below. Lines are also engraved on the chart to show the approximate limit of the pack ice during the southern summer months, the line of freezing-point in air in January and February, the northern limit of icebergs, and the tracks of the *Challenger*, *Valdivia* and *Belgica* expeditions. It is a little to be regretted that the proposed tracks of the expeditions about to start are not also included, so that the fields of operations of the German and British expeditions could be easily distinguished.

THE paper by Prof. S. P. Langley and Mr. F. W. Very, "On the Cheapest Form of Light," which appeared in the *American Journal of Science* in August, 1890, has been reprinted and published as No. 1258 of the Smithsonian Miscellaneous Collections, with a note pointing out some of the additions to our knowledge of the light from living and mineral sources during the last ten years. It will be remembered that the paper deals with the light of the fire-fly and shows that the insect produces light without heat, so that its efficiency as a light source is far higher than any artificial means of illumination. In connection with this subject, the luminous bacteria cultivated by Mr. J. E. Barnard and Prof. Allan Macfadyen, and shown at the last Royal Society conversazione (see p. 57) are of interest.

THE additions to the Zoological Society's Gardens during the past week include a Vervet Monkey (*Cercopithecus lalandii*) from South Africa, presented by Mr. Crandon W. Gill; an Alpine Marmot (*Arctomys marmotta*), European, presented by Mrs. Curtis; a Rough-keeled Snake (*Dasypeltis scabra*), four Rhomb-marked Snakes (*Trimerorhinus rhombeatus*, four Rufescent Snakes (*Leptodira hotamboeia*), three Crossed Snakes (*Psammophis crucifer*), a Coppery Snake (*Prosymna sundevalli*), a Delalande's Lizard (*Nucras delalandii*) from South Africa, presented by Mr. A. W. Guthrie; two Pond Herons (*Ardeola grayi*), a Cattle Egret (*Bubulcus coromandus*), a White-bellied Drongo (*Dicrurus coerulescens*), a Common Hawk Cuckoo (*Hierococcyx varius*), two Baya Weaver-birds (*Ploceus baya*), two Scarlet-backed Flower-peckers (*Dicoeum cruentatum*), two Purple-rumped Sun-birds (*Arachnechthra zeylonica*), a Himalayan Black Bulbul (*Hypsipetes psaroides*) from British India, presented by Mr. E. W. Harper; two European Pond Tortoises (*Emys orbicularis*), European, presented by the Hon. Mrs. Fitzgerald; an Algerian Tortoise (*Testudo ibera*) from North Africa, three South Albemarle Tortoises (*Testudo vicina*), two Central Albemarle Tortoises (*Testudo*, sp. inc.) from the Galapagos, deposited; two Herring Gulls (*Larus argentatus*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN AUGUST.

August 2. 2h. Mercury at greatest elongation, 19° 23′ West.
4. 14h. 39m. to 15h. 47m. Moon occults δ Piscium (mag. 4·6).
6. 12h. 16m. Minimum of Algol (β Persei).
9. 9h. 5m. Minimum of Algol (β Persei).
11. Maximum of Perseid meteoric display (radiant 45° + 57°).
13. Saturn. Outer minor axis of outer ring = 17″·94.
15. Venus. Illuminated portion of disc = 0·873, of Mars = 0·915.
15. 7h. 21m. to 10h. 26m. Transit of Jupiter's Sat. III. (Ganymede).
17. 6h. 12m. to 8h. 32m. Transit of Jupiter's Sat. IV. (Callisto).
25. 6h. Saturn in conjunction with the moon. Saturn 3° 42′ S.
28. 12h. 54m. to 13h. 59m. Moon occults c' Capricorni (mag. 5·2).
29. 12h. 29m. to 13h. 29m. Moon occults κ Aquarii (mag. 5·5).
29. 10h. 47. Minimum of Algol (β Persei).

THE PARIS OBSERVATORY IN 1900.—A Paris correspondent sends us the following note:—The annual report drawn up by M. Maurice Lœwy, director of the Paris Observatory, and adopted by the Observatory Council, has been sent to the National Printing Office for publication. The international mapping of stars not being in operation in three different parts of the southern hemisphere, M. Lœwy, president of the committee, has sent representations to these countries, through diplomatic agencies, with the result that work will soon begin in them. Mr. Thome, director of the National Observatory, Cordoba, has written to M. Lœwy that the Argentine Republic has authorised him to organise an astrophysical service. Mr. Cooke, director of the Perth Observatory in Southern Australia, has been notified by the Colonial Office that a special grant will be at his disposal for the future budget. M. Enrique Legrand, of the Uruguay Republic, has persuaded H.E. M. Cuertas to present a bill for the establishing of an astrophysical service in Montevideo. The work is progressing favourably in all the countries where it has been inaugurated.

M. Lœwy is investigating Prof. Turner's method of determining, from photographs, the positions of the celestial bodies with almost the same exactness as from direct observations in the sky. The report gives for the first time a complete list of the fifty-eight observatories which have taken part in the Eros international observations. According to the last news included in the report, January 6, no single night had passed, since the inauguration of this work, without at least one observatory having made at least one Eros observation. On favourable nights the number of observations exceeded one hundred. MM. Prosper Henry and Boinot took 104 series of photographs of the planet Eros from October 3 to January 6.

Six hundred and seventy stars at a distance of not more than one degree from the path followed by Eros were observed with the meridian circle. For the first time observations of stars were registered on the meridian with a special chronograph invented by the Abbé Verschaffel. Ten sheets, containing 16,500 stars, of the photographic catalogue of the heavens, have been published. Each of these sheets contains a zone of one degree in declination

and eight minutes in Right Ascension. Photogravures for the Lunar Atlas have been prepared for publication; they refer to the first and last quarter. On the occasion of the total eclipse of May 28, MM. Hamy and Bigourdan were sent to Spain and were favoured with splendid weather for their observations. M. Bigourdan continues his observations of nebulæ, and the work of his great catalogue is progressing favourably. M. Callandreau observed with the great equatorial of the western tower, and used a wire illuminated only by points in the field of his refractor; he appears to be satisfied with this method, which prevents the eye from being disturbed by too great a quantity of light when observing feeble stars.

M. Gaillot has worked at the theory of Saturn, using Le Verrier's formulæ, and has succeeded in showing that the discrepancies between the results of computation and observation should be attributed to the fact that a sufficient number of terms had not been taken into consideration.

A staff of six women observers, directed by Miss Dorothea Klumpke, has determined the position of 29,627 stars for the International Catalogue. This is the only department of the Observatory where ladies have been admitted. To the meteorological department a new registering barometer has been added; it is a mercury one, and the end of the index runs through 3 mm. for a variation of 1 mm. in mercury. The publication of the old observations from 1837 up to 1886 will be completed this year, and from 1886 on the observations will be published regularly each year. The observations of 1898 were published in 1900, and those of 1899 will appear shortly.

PHOTOGRAPHY BY THE LIGHT OF VENUS.—In the autumn of last year several meagre accounts appeared in various journals announcing that Dr. W. R. Brooks had succeeded in obtaining good photographic records solely by means of light from the planet Venus. In the *Century Magazine* for August (1901), Dr. Brooks has an article describing his experiences, illustrated by reproductions of the photographs obtained at the Smith Observatory. These are chiefly positives taken by placing a landscape or other negative in a printing frame with a sensitive plate and exposing to the light from the planet, care being taken to shield the frame from all extraneous light. The results described were obtained when the planet was a morning star, shortly after September 17, 1900. Gelatine dry plates (speed not stated) were used, the exposures given varying from thirty to forty-five minutes. A print on bromide paper was obtained by exposure on five consecutive clear mornings. The positives are all apparently well exposed, and a portrait is also shown as being produced by the planet's light, but by what procedure is not indicated.

NEW NEBULÆ.—In the *Comptes rendus* (cxxxiii. pp. 206-208), M. Bigourdan continues his catalogue of new nebulæ discovered with the west equatorial of the Paris Observatory. Particulars as to position, notes of special interest and comparisons with other catalogues are given for twenty-three objects observed between 1884 and 1898.

THE CRYSTALLISATION OF SALT SOLUTIONS.

ALTHOUGH the processes of crystallisation have been known to, and made use of by, chemists for ages, yet it is only within the last few years that the phenomenon of crystallisation from solution has been the subject of systematic investigation. The pioneer work in connection with this systematic study on the basis of modern principles has been done, for the most part, by Dutch chemists. The researches of Roozeboom on the equilibrium of systems in contact with water have shown clearly the importance of the phase rule of Willard Gibbs as a guide in the study of the complex phenomena of heterogeneous equilibrium. The study in van 't Hoff's laboratory of the conditions of existence of crystallohydrates and of the phenomena associated with the formation and decomposition of double salts in contact with water has given us invaluable material for a correct understanding of the processes of crystallisation. Not only is the systematic investigation of this phenomenon of importance to the chemist, but the geologist is also dependent on such knowledge for the final explanation of the conditions of formation of the vast oceanic salt deposits.

A knowledge of the composition of the solution in equilibrium with a system of solid substances is obviously an all important factor for the study of the processes of crystallisation, for the separation of any solid substance from the solution requires that the solution shall be saturated with regard to that substance. In what follows it is presumed that the crystallisation takes place so slowly that supersaturation phenomena can be neglected, and the complications resulting from crystallisation of isomorphous mixtures are also left out of account. Furthermore, we suppose that the temperature of the solution remains constant during the crystallisation.

The simplest conditions are then met with in the case of a solution containing a single substance, say a salt, which is not capable of combining with water of crystallisation. If an unsaturated solution of such a salt is evaporated, the commencement of crystallisation is conditioned solely at a given temperature by the attainment of a definite concentration. As evaporation proceeds the salt then separates out continuously, the composition of the solution undergoing no change until the last trace of water has been removed.

If the dissolved salt forms crystallohydrates, *i.e.* salts with water of crystallisation, then the products of isothermal evaporation are dependent upon the temperature, a less hydrated form separating as the temperature is higher. Thus solutions of manganese chloride yield the tetrahydrate if the temperature does not exceed 58° C., whereas at higher temperatures the dihydrate crystallises out. It is well known that salts containing water of crystallisation undergo at a definite temperature a change in which the whole or part of the water of crystallisation is split off. Glauber's salt loses its ten molecules of water at 32·4° C.; ordinary zinc sulphate containing seven molecules of water yields the hexahydrate at 39° C., and this again, at a higher temperature, yields a lower hydrate. These temperatures are known as the transition temperatures of the salt hydrates, and have a far-reaching analogy with the melting points of solid substances.

The limiting temperatures corresponding to the crystallisation of a definite hydrate from the salt solution are determined by the transition temperatures of the solid hydrates.

If supersaturation phenomena intervene we may observe the separation of hydrates from solution at temperatures below the normal limiting temperature. It is, however, only under this condition that crystallisation of such unstable hydrates takes place, for at a given temperature the unstable hydrates are more soluble than the stable hydrate. If the solution from which an unstable hydrate has begun to crystallise out be impregnated with the hydrate of smaller solubility, the unstable hydrate will redissolve and crystallisation of the normal hydrate ensues.

If a solution contains two dissolved salts having a common ion, the phenomena of crystallisation are about as simple as in the case of a solution containing a single salt. Let us suppose, in the first instance, that these salts do not unite to form a double salt, and that they do not form crystallohydrates. Such a solution is one containing the chlorides of sodium and potassium, and in this case a knowledge of the composition of the three solutions, saturated respectively with regard to each single salt and with regard to both simultaneously, enables us to predict what will take place on isothermal evaporation. A graphic representation of the solubility data facilitates the tracing of the crystallisation process very considerably, and the composition of the various solutions is conveniently expressed by the number of molecules of dissolved salt per 1000 molecules of water. Fig. 1 contains the data for the system consisting of water, potassium chloride and sodium chloride at 25° C., A representing the saturated solution of sodium chloride, B that of potassium chloride, and C the solution saturated with regard to both.

Along the curve A C we have solutions saturated with regard to sodium chloride in which the potassium chloride concentration gradually increases. Similarly, the points along the curve B C represent solutions containing increasing quantities of sodium chloride, all of which are saturated with reference to potassium chloride.

All points within the figure O A C B represent unsaturated solutions, the quantities of the dissolved salts being given by the lengths of the projections on the axes. If a solution corresponding to the point *c* is slowly evaporated at 25° C., the change in the composition of the solution will be represented by the continuation of the line O *c* (O corresponding to pure water). At the point *d*, where this line meets the curve B C, the solution becomes saturated with potassium chloride and the latter crystallises from solution. By the continued separation of potassium chloride the relative proportion of